

KARIOTAXONOMIC STUDIES ON WILD BOLIVIAN  
TUBER-BEARING SOLANUM, SECT. PETOTA. (II)

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*This is the second and final paper on this subject. The first part was published in Phytologia Vol. 55(1):16-40, 1984 and had the same title. On page 26 of the first paper the subtitle for Group VI, Series Tuberosa, was omitted, S. alandiae is the first species of this group which is listed until page 34 with S. sucrensis as the last species.*

*In the meantime, two more publications have appeared on the same subject, and their titles are "New tuber-bearing Solanum taxa from Bolivia and Northern Argentina" by J.G. Hawkes and J.P. Hjerting in Jour. Linn. Soc., Vol. 86(4):405-417, 1983 and "Solanum venatoris (Sect. Petota) a new species from Bolivia" by C. Ochoa in Phytologia Vol. 55(5):297-298, 1984. All of the species considered in these two papers are also included in the present treatment. Finally, our monographic work on the Bolivian tuber-bearing Solanum is ready for publication.*

II. SERIES CIRCAEIFOLIA Hawkes, Ann. and Mag. Nat. Hist., ser 12, 7:702. 1954.

*Solanum soestii* Hawkes et Hjerting. Bot. Jour. Linn. Soc. 86(4):406, 409-410, fig. 3, 1983.

*Plant gracile, usually 20-30 cm tall, glabrescent; stem terete 2.0-2.5 mm thick. Tubers small 0.7-1.5 cm in diameter, white. Leaves light green (2-)3-4 pairs of lateral folioles, mostly without interjected leaflets or few (2-3); folioles narrowly lanceolate or even linear-lanceolate, apex acute, base rounded or shortly attenuated in the terminal foliole, oblique in the laterals with short petiolules or sometime narrowly decurrent on the rachis, especially in the upper pair. Inflorescence cymose, 2-5 flowers; articulation above the center of the pedicel or near the upper third. Calyx small, lobes with very narrow acumens. Corolla stellate, creamy white, small, 20 mm in diameter. Fruit narrowly long conical with apex acute, 2.5-2.8 cm long, light green with 1-2 vertical green dark strips.*

*Because of its leaf dissection, this species —recently discovered by Hawkes and Hjerting— appears to be so closely related to S. circaeifolium and its variants, that we are inclined to group it as a variety of S. circaeifolium. However, more information is needed and therefore we have left this species in the position originally presented. Distribution: From the vicinity of Quime 2900 m to Cancho 2850 m and Rosanani 2750 m route to Inquisivi, Province of Inquisivi, Department of La Paz, mostly in damp soil, humid and cloudy regions. Growing in open fields associated with natural grasses or in small thickets or margins of woods together with Barnadesia, Begonia, Calceolaria and other non-tuber-bearing Solanum. Chromosome number:  $2n=2x=24$ .*

IV. SERIES CONICIBACCATA Bitt., *Repert. Sp. Nov.* 11:381, 1912

SERIES OXYCARPA Rydb., *Bull. Torrey Bot. Club.* 51:146, 172, 1924

*Solanum bombycinum* Ochoa. *Am. Bot. Jour.* 60:849-852, Fig. 1, 1983.

Plant stout, frequently 1 m or more tall; stem erect, terete, near 10 mm thick. Tubers round to ovate, up to 7 cm long, irregularly pigmented with light purple or light mauve. Leaves dark green, very pubescent, almost velvety; in the young leaves, 1-2(-3) pairs of leaflets; terminal leaflets ovate-lanceolate to broadly elliptic-lanceolate or even sub-orbicular, larger than the laterals, apex very acuminate, base broad rounded cordate or subcordate; lateral leaflets elliptic-lanceolate to narrowly ovate lanceolate, subsessile. Inflorescence cymose, few flowers (2-7). Articulation of the pedicel near the center or slightly below the center. Calyx 7-9 mm densely pilose. Corolla rotate-pentagonal to definitely pentagonal, purple, 2.5-2.8 cm in diameter, acumens whitish on the outside; filaments scarcely pilose. Fruit large conic or long ovate conic, dark green, 2.5 cm long.

This species is native to a humid tropical region where rainfall is high. Grows mainly in dense thickets associate with grasses, orchids, Oxalis, and is protected by great masses of Chusquea. *Solanum bombycinum* has some morphological factors in common with *Solanum villuspetalum* of a similar habitat but native to the Urubamba Cañon, near Machupicchu, Southern Peru. Distribution: Seems to be very scarce. Has been found only in one remote locality, Chullumayu at 2000 m alt., in route to Mojos, Province Franz Tamayo (formerly Province Caupolican), Department of La Paz. Chromosome number:  $2n=4x=48$ .

*Solanum neovavilovii* Ochoa, *Am. Bot. Jour.* 60:919-923, Fig. 1, 1983.

Plant up to 60 cm, or more, tall; stem erect or decumbent (3-) 5-7 mm thick, very sparsely pilose throughout, very narrowly winged. Tubers round, ovate, to oval compressed or long sub-cylindrical, up to 5.5 cm long, white. Leaves 3-4 pairs of folioles, 0-3(-5) interstitial leaflets. Folioles elliptic-lanceolate or narrowly elliptic lanceolate, apex obtuse or subacute, base rounded or shortly oblique sessile or shortly, petiolulate, rather very pilose on the upper surface, glabrescent or sparsely pilose on the lower surface. Inflorescence cymose, few flowers, (2-)5-7. Articulation little above the center of the pedicel, or towards the upper third, pedicels shortly pilose. Calyx 5-6 mm long, glabrous or glabrescent. Corolla rotate-pentagonal 2.0-2.5 cm in diameter, sky blue or very light blue with white acumens; the external side of the corolla, sky blue with narrow white band extending from each acumen all the way to the base of the petal, forming a white star. Fruit long ovate conic, light green, up to 2.5 cm long.

*Solanum neovavilovii* has close affinities with only one other species *S. limbaniense* Ochoa, from South East Peru. However, there are also well marked differences between them, particularly in the shape and dissection of the leaves, and those two taxa should be maintained as separate species. Distribution: The habitat of *S. neovavilovii* belongs to the typical climatic conditions of the eastern slopes of the Andes; that is to

say, moderate temperature, abundant rainfall, humid and cloudy atmosphere, found mainly between 2500-3200 m alt. among abundant vegetation, mostly shrubby with occasional relicts of woods or definitely in large forested areas. The main area of distribution of *S. neovavilovii*, as known so far, is in the region of Mayupampa and Chimpainioc, North of the Province of Franz Tamayo (formerly Province Caupolican) in the Department of La Paz. Chromosome number:  $2n=2x=24$ .

VI. *SERIES TUBEROSA* Rydb., Bull. Torrey Bot. Club 51:146-148, Buk. & Kameraz, Bases of Potato Breeding 18, 1959, sensu stricto. 1924, nomen nudum.

*SERIES ANDREANA* Hawkes, Bull. Imp. Bur. Plant Breed. Genet. Cambridge 2:50, 1944.

*SERIES ANDIGENA* Buk. ex Buk. & Kameraz, Bases of Potato Breeding 24, 1959.

*SERIES TRANSAEQUATORIALIA* Buk. ex Buk. & Kameraz, Bases of Potato Breeding 21, 1959.

*SERIES VAVILOVIANA* Buk. ex Buk. & Kameraz, Bases of Potato Breeding 18, 1959.

*SERIES MINUTIFOLIOLA* Corr. (Texas Res. Found. Contrib. 4:216-218, 1962).

*Solanum candelarianum* Card. Bol. Soc. Peruana Bot. 5(1-3):12-13, 19; Lam. 1 (B), figs. 1-5, 1956 (no *S. candelarianum* Buk. de Mexico, sin diagnosis en Latin. En: Bull. Appl. Bot., Genet. and Pl. Breed., Suppl. 47:60, 218, 1930)

*Solanum avilesii* Hawkes et Hjerting Bot., Jour. Linn. Soc. 86(4): 410-412, fig. 4, 1983.

Plant usually small, 10-20(-40) cm tall, pilose throughout; stem erect, narrowly winged, simple or branched, 3-4 mm thick towards the base. Tubers round, 2-3 cm in diameter, white. Leaves dark green, very pilose including the foliole margins (1-)2-3 pairs of lateral folioles, without or few interjected leaflets (0-2); terminal foliole larger and broader than the laterals, widely elliptic to elliptic-lanceolate, apex acute to sub-acuminate, base shortly attenuate; lateral leaflets elliptic to oblong or ovate-oblong, apex acute, base rounded or oblique, sessile or shortly petiolulate, the upper leaflet pair very narrowly decurrent on the rachis. Inflorescence cymose 5-7(-12) flowers; articulation above the center or in the upper third of the pedicel. Calyx small 4-5(-6) mm, lobes with 2 mm narrow acumens. Corolla rotate-pentagonal, deep violet-purple, 2.5-3.0 cm in diameter. Fruit globose, 1.5-2.0 cm in diameter, dark green.

*Solanum candelarianum* was discovered a long time ago by Cardenas. (March 1955). Unfortunately, type or isotypes of this species do not exist; assuming that they have been lost for ever, we consider our number C. Ochoa y A. Salas 15542 as a neotype of *S. candelarianum*. During our collecting trips in Bolivia, we have rediscovered this species in its original type locality, between Candelaria and Pucará, in the Province of Valle Grande. The species *S. avilesii*, recently described by Hawkes and Hjerting, from the same area, is only a synonym of *S. candelarianum*. Distribution: So far only in the Province of Carrasco in the Department of Cochabamba and in the Province of

Valle Grande in the Department of Santa Cruz. Growing in rather cold regions and semi-dry or sub-xerophytic places, with poor vegetation, it is sometimes associated with small colonies of Bromeliaceae (*Puya*, *Pitcairnia*) and thorny shrubs at altitudes of 2300-3200 m. Chromosome number:  $2n=2x=24$ .

*Solanum doddsii* Correll, *Wrightia* 2:186, 1961

Plants 50 cm or more tall, glabrous or glabrescent, stem simple or branched, very narrowly winged. Tubers white, round to ovate 2-3 cm long. Leaves 3-5 pairs of lateral folioles without or with few interjected leaflets, (-0)5-7. Folioles elliptic-lanceolate to ovate-elliptic, apex acute or subobtuse, base obliquely rounded with long petiolules, (10 mm); margin very minutely denticulate, shortly ciliate. Inflorescence cymose-paniculate, 6-8 flowers. Articulation above the center of the pedicel, or near the upper third. Calyx 8 mm long, lobes 1.5-2.0 mm acuminate. Corolla rotate-pentagonal to pentagonal, light lavender, 3 cm in diameter. Fruit globose to ovoid, 2.5 cm long, light green uniform.

*Solanum doddsii* has affinity with *S. alandiae*. The calyx shape and anthers, the typical color of the corolla, the position of the articulation of the pedicel are, among others, strong elements of resemblance between these species. However, the shape and dissection of the leaves, the fine denticulation of the folioles, the very thin, almost filiform pedicels in addition to the great difference in the indument and plant habit, are very strong factors for maintaining both species as separate entities. Although, *S. doddsii* has been postulated to be a natural hybrid between *S. chacoense* and *S. alandiae* by Hawkes, the results obtained in our research with artificial hybrids between both species do not confirm this hypothesis. Distribution: *Solanum doddsii* grows in semi-dry or sub-xerophytic places on steep rocky slopes in the shade of trees like *Schinus*, or *Allnus* or among shrubs. Its geographical distribution is very limited, it has been found only between the Northern Province of Oropeza in the Department of Chuquisaca and Aiquile and Totora in the provinces of Campero and Carrasco in the Department of Cochabamba at 2200 and 2400 m of altitude. Chromosome number:  $2n=2x=24$ .

*Solanum neocardenasii* Hawkes and Hjerting, *Bot. Jour. Linn. Soc.* 86(4):411, Fig. 5-413, 1983.

Plant gracile, usually 25-30 cm tall, very glandulous, covered throughout with short and long glandular hairs, also with very sparsely non glandular hairs. Tubers small, 1.0-1.5 cm long, round or ovate, white. Leaves very delicate, (4-)5-6 pairs of lateral folioles without or with variable number of interjected leaflets, (0-)5-9 (-14), of several sizes; folioles ovate-lanceolate to triangular lanceolate, apex obtuse, basis cordate with very long petiolules, up to 20 mm long or more. Inflorescence cymose with few flowers, 5-7. Articulation near the calyx, scarcely 2-3 mm below. Calyx small, 4.5-5.0 mm, lobes shortely acuminate. Corolla rotate, small up to 8 cm in diameter, white, short acumens. Fruit globose to ovate, light green with 1-2 darker green narrow vertical bands.

*Solanum neocardenasii* is typical for a xerophytic habitat, grows associated with Bromeliaceae, large woods of Cactaceae, thorny thickets and trees. Distribution: So far its distribution is limited to the Northwest of the Department of Santa Cruz in the Provinces of Florida and Valle Grande between 1400-1700 of altitude. Chromosome number:  $2n=2x=24$ .

*Solanum okadae* Hawkes and Hjerting, Bot. Jour. Linn. Soc. 86(4):414, 417, Fig. 7-416, 1983.

*Solanum venatoris* Ochoa, Phytologia 55(5): 297-298. Illustr.

Plant usually 40-60 cm tall, stem (2.5-)3.5-5.0 mm thick towards the base, very narrowly winged. Tubers round, white, small, 2.0-2.5 cm in diameter. Leaves short and wide, sparsely pubescent, 2-3(-4) pairs of lateral folioles, 0-4 interjected leaflets; terminal leaflet larger and broader than the laterals, very broad ovate to broadly elliptic-lanceolate or even sub-orbicular, apex acuminate, base rounded or subcordate, lateral leaflets elliptic-lanceolate to broad ovate, acuminate. Inflorescence cymose-paniculate, few flowered (5-6); articulation of the pedicel near the upper third. Calyx 8-9 mm long, lobes narrowly elliptic-lanceolate of variable length (3-7 mm) narrow sub-spathulate or almost linear acumens. Corolla rotate to rotate-pentagonal, white, 2.5-3.5 cm in diameter. Fruit globose, dark green, 1.5 cm in diameter. Chromosome number:  $2n=2x=24$ .

I only learned about the discovery of *S. okadae*, after my diagnosis of *S. venatoris* had gone to press. *S. venatoris* must now be considered a synonym of *S. okadae*.

*Solanum achacachense* Cárdenas Bol. Soc. Peruana Bot. 5:30-31. Lam. II, fig. F; Lam. IV, fig. C. 1956.

Plant small, usually 8-12 cm tall, sub-rosulate at the base; stem erect, 1.5-2.5 mm thick, sparsely pilose, coarse white-silvery hairs; tubers white, round, small 6-10 mm in diameter. Leaves with 2-3 pairs of lateral leaflets provided with scattered white hairs on both surfaces including the rachis, interjected leaflets absent. Leaflets elliptic to elliptic-lanceolate attenuate at apex and base; terminal leaflet larger than the laterals, lateral leaflets sessile or sub-sessile, the upper pair slightly decurrent on the rachis. Peduncle 4-6 cm long, pilose as the pedicels and calyx. Articulation near the upper third. Calyx 5 mm long. Corolla rotate to rotate-pentagonal, light purple or violet-blue, showy, usually large, 3.0-3.5 cm in diameter. Chromosome number:  $2n=2x=24$ .

Due to the absence of the holotype or isotypes or any other material of *S. achacachense* in the different Herbaria that we have reviewed, including the Cárdenas Herbarium in Bolivia, we used to consider this species to be a synonym of *S. brevicaulis* (Phytologia; Vol. 55(1):29, 1984) which Correll had also pointed out a long time ago (The Potato and its Wild Relatives, pp. 437, 1962). However, after some unsuccessful attempts in the past, *S. achacachense* was recently found in its type locality. The morphological characteristics given above are based on this finding which now represents the Neotype of *S. achacachense* Cárdenas under our number C. Ochoa 14901. Distribution: It has so far only been found in its type locality which is near the highest

pass between Achacachi-Huarisata to Sorata, at 4000 m alt. This place is a typical environment of the Puna, cold and windy with poor vegetation, with humid and stony soil. This species is associated with some small plants of *Stipa ichu*, *Lupinus microphyllum* and also found near *Lobivia* sp. Chromosome number  $2n=2x=24$ .

*Solanum virgultorum* (Bitt.) Cárđ. et Hawkes, *Jour. Linn. Soc., Bot.* 53:103, fig. 8. 1945.

*Solanum boliviense* subsp. *virgultorum* Bitt., *Repert. Sp. Nov.* 12:153-154. 1913.

Plant low, 25-30 cm tall, pubescent throughout; stem erect, simple or slightly branched, some flexuous with short internodes of 1.5-3.0 cm long. Tubers small 1.0-1.5 cm in diameter. Leaves 1-2 pair of folioles without interjected leaflets, pluricellular acute hairs on upper surface; leaflets of upper pair prominent, second pair smaller, leaflets not decurrent on the rachis. Terminal leaflet broadly ovate, apex acute or abruptly acuminate, base obliquely rounded or subcordate. Peduncle 4-6 cm long; pedicels articulated near the center or slightly above the center. Corolla rotate-pentagonal 2.5-3.0 cm in diameter, light purple. Distribution: In the humid valleys of Quime, Province of Inquisive, and vicinities of Sorata and near Tacacoma, Province of Larecaja, Department of La Paz. Growing mostly in altitudes between 2650 and 3300 m alt., of tempered clima, in gorges, cliffs or steep slopes, usually associated with shrubby vegetation.

*Solanum microdontum* Bitt. *Repert. Spec. Nov.* 10:535-536, 1912.

*Solanum bijugum* Bitt., *Repert. Spec. Nov.* 10:533, 1912.

*Solanum simplicifolium* Bitt. subsp. *microdontum* (Bitt.) Hawkes, *Scottish Pl. Breed. Sta. Ann. Rpt.* 92. 1956.

*Solanum cevallos-tovari* Cárđ., *Bol. Soc. Peruana Bot.* 5:13-15 Lam. IV (A), *fototipo.* 1956.

*Solanum higuieranum* Cárđ., *Bol. Soc. Peruana Bot.* 5:20-21, Lam. I(F), figs. 1-8. 1956.

*Solanum microdontum* subsp. *microdontum* (Bitter) Hawkes and Hjerting, *Phyton, Graz* 9, 144-146, 1960.

Plant usually stout, stem simple or branched up to 2 m tall and up to 20 mm thick, simple to branched, green or irregularly to deeply pigmented with purple anthocyanin; stem winged up to 5 mm wide, wings green or pigmented, straight, undulate or crisped, margin entire or crenulate glabrous or with few large coarse hairs. Tubers round to ovate pink-mauved to brown. Leaf irregularly dissected sometimes simple but usually with 1-2(-3) pairs or leaflets, without interjected leaflets; margin of leaflets more or less entire to minutely denticulate. Pseudoestipular leaves semilunate and auriculate. Inflorescence 4-25 flowers, peduncle up to 10 cm long, pedicels articulated

at the center or at slightly below or slightly above the center. Calyx up to 9 mm long, lobes narrowly ovate to subquadrate or lanceolate-acuminate with uniguely lenth acumens. Corolla rotate to rotate-pentagonal or pentagonal up to 4 cm in diameter, white, very seldom pigmented with light purple or blue lavender. Fruit globose to ovoide or long conic. Distribution: Has an extensive geographical distribution from the Sierras de Famatina in the province of La Rioja, Argentina (29°07' S and 67°38' W) up to Tranca Jahuira in the province of Inquisivi in the Department of La Paz, Bolivia (17°02' S and 68°47' W). Its altitude range varies from 1200 m to 3200 m prefers, however, the altitudes between 1600-2700 m. Lives preferentially in the rainy forest of the Selva Tucumano Boliviana or Montano district and is extended up to the open formations of alpine or pajonal vegetation. Chromosome number  $2n=2x=24$ .

*Solanum microdontum* var. *microdontum* (Bitt.) Ochoa (see synonyms under *S. microdontum*.)

Plant of variable vigor, delicate to stout, up to 1 m tall, stem up to 8 mm thick, wings 1-2 mm wide, straight or undulate, not denticulate, glabrescent. Leaf usually dissected, folioles of upper pair not very much small than the terminal. Corolla rotate-pentagonal to pentagonal, white. Fruit globose, light green, up to 2 cm in diameter.

*Solanum microdontum* var. *gigantophyllum* (Bitt.) Ochoa

*Solanum gigantophyllum* Bitt., *Repert. Sp. Nov.* 11:368-369, 1912.

*Solanum simplicifolium* Bitt., *Repert. Sp. Nov.* 11:369-370, 1912.

*Solanum simplicifolium* ssp. *gigantophyllum* (Bitt.) Bitt., *Repert. Spec. Nov.* 12:445, 1913.

*Solanum simplicifolium* var. *metriophyllum* Bitt., *Repert. Spec. Nov.* 12:445, 1913.

*Solanum simplicifolium* var. *mollifrons* Bitt. *Repert. Spec. Nov.* 12:445-446, 1913.

*Solanum simplicifolium* var. *trimerophyllum* Bitt. *Repert. Spec. Nov.* 12:446, 1913.

*Solanum simplicifolium* var. *variabile* Brucher et Ross, *Lilloa* 26:465, Lam II Fig. A, 1953. (as *S. variabilis*).

*Solanum simplicifolium* subsp. *venturii* Hawkes, *Scott. Pl. Breed. Sta. Ann. Rept.* 92, 1956.

*Solanum microdontum* subsp. *gigantophyllum* (Bitt.) Hawkes et Hjerting, *Phyton* 9:144-146, 1960.

*Solanum tafiense* Lillo, nomen nudum

Plant usually vigorous up to 2 m tall, stem up to 20 mm thick towards the base, always winged, wings up to 5 mm wide, undulate or strongly crisped, margin denticulate or irregularly crenulate. Leaf usually simple; in the simple-leaved forms, the leaf lamina usually large or very large, elliptic to ovate-lanceolate or even rotundo-cordate, apex acute or acuminate, base decurrent on the rachis. Foliolles of the upper pair, when present, normally much more smaller than the terminal. Corolla rotate-pentagonal to sub-stellate, white, lobes narrowly or widely triangular-ovate. Fruit globose, light green.

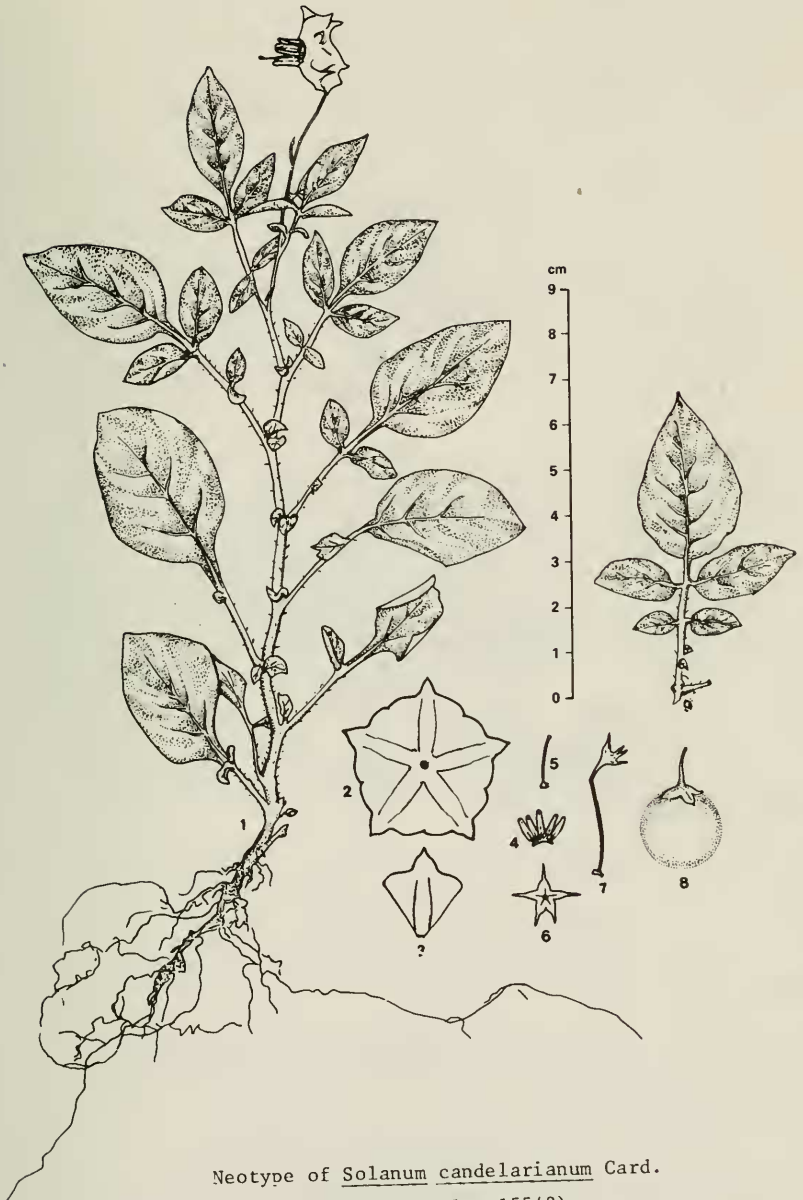
*Solanum microdontum* var. *montepuncoense* Ochoa

Plant vigorous up to 1.5 m tall, stem up to 12 mm thick, shortly and densely pilose, deeply pigmented with purple anthocyanins, widely winged, wings light green up to 5 mm wide straight or sinuous, margin entire or denticulate, glabrescent. Leaf 1-2 pair, folioles of the upper pair slightly smaller than the terminal. Corolla rotate, light purple or lilac, white acumens. Fruit ovate-conic or long-conic, light green, 2.0-2.5 x 1.4-1.6 cm.

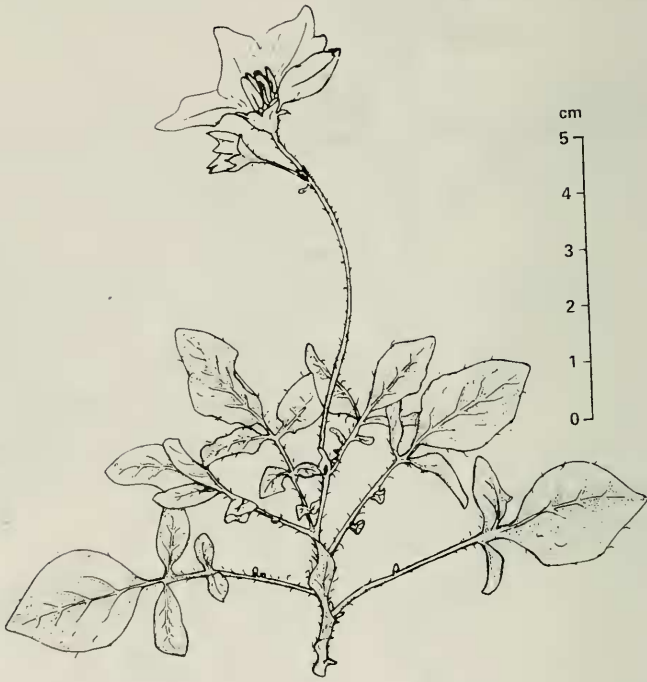
In summary, at the present time, we consider that there is a total of 31 Bolivian wild tuber-bearing *Solanum* species grouped as follows:

<i>Serie Acaulia:</i>	<i>S. acaule</i>
<i>Serie Circaeifolia:</i>	<i>S. circaeifolium</i> and <i>S. soestii</i>
<i>Serie Commersoniana:</i>	<i>S. berthaultii</i> , <i>S. chacoense</i> , <i>S. flavoviridens</i> , <i>S. litusinum</i> , <i>S. tarijense</i> and <i>S. yungasense</i>
<i>Serie Conicibaccata:</i>	<i>S. bombycinum</i> , <i>S. neovavilovii</i> and <i>S. violaceimarmoratum</i>
<i>Serie Cuneolata:</i>	<i>S. infundibuliforme</i>
<i>Serie Tuberosa:</i>	<i>S. achacachense</i> , <i>S. alandiae</i> , <i>S. brevicaule</i> , <i>S. candelarianum</i> , <i>S. candolleum</i> , <i>S. doddsii</i> , <i>S. gandarillasii</i> , <i>S. leptophyes</i> , <i>S. microdontum</i> , <i>S. neocardenasii</i> , <i>S. okadae</i> , <i>S. oplocense</i> , <i>S. sparsipilum</i> , <i>S. sucrense</i> , <i>S. vidaurrei</i> and <i>S. virgultorum</i>
<i>Serie Megistacroloba:</i>	<i>S. boliviense</i> and <i>S. megistacrolobum</i>





Neotype of *Solanum candelarianum* Card.  
(Ochoa et Salas 15542)



Neotype of Solanum achacachense Card.

(Ochoa 14901)